



Captain Charles C. Wieland
Communication/Electronics Department

If our nation were to be involved in war tomorrow, our Army would be employed in a manner only dreamed of a few years ago. Units would be required to move rapidly in highly coordinated maneuvers over great distances. Troops would employ sophisticated weapons with tremendous firepower and "unheard of" accuracy. All this could be accomplished only with the use of effective communication and electronic systems. With so much reliance on communication and electronics, a new dimension has been added to the battlefield—electronic warfare.

Electronic warfare includes all actions taken to reduce the effectiveness of radiated electromagnetic energy used by the enemy and to insure the effectiveness of friendly radiated electromagnetic energy. The important role electronic warfare can play in future wars is easily appreciated if you will visualize what would happen if an enemy could, at critical moments, completely wipe out our Army's radio communication, navigational aids, radar, missile guidance, and projectile fuze control. A complete stroke is unlikely; however, a vital advantage can often be won even by a partially successful application of the tactics and techniques of electronic warfare.

Electronic warfare is divided into two functions. The first of these, electronic countermeasures (ECM), is the military use of electronics to reduce the effectiveness of military electronic equipment and tactics. This includes passive measures, for example, communication intelligence, and active measures such as jamming and deception. Radio jamming is

the transmission of interfering radio signals which obscure the reception of other signals, thereby nullifying the effectiveness of radio equipment. Personnel and agencies outside the artillery perform this function.

Artillerymen are directly concerned with the second function of electronic warfare. This function is known as electronic counter-countermeasures (ECCM) or, more simply, all the measures taken to insure the effective use of friendly electromagnetic radiations *despite* the enemy's use of electronic countermeasures. These measures include transmission security to protect transmissions from interception and traffic analysis and, equally important, antijamming measures to reduce or nullify the effect of jamming.

ALL COMMANDERS RESPONSIBLE FOR TRANSMISSION SECURITY

Commanders at all echelons are responsible for transmission security. All users of communication systems must be aware of the need for transmission security and the means by which it is achieved. The following rules must be practiced not only by assigned radio operators but by all military personnel:

- (1) The number of radio transmissions must be kept to a minimum and as short as possible. Make only authorized transmissions and transmit at a speed that will preclude unnecessary repetition.

- (2) Classified material will be sent in the clear only when specifically authorized. Identification of units, locations, and individuals must be avoided.

- (3) Station and message authentication should be used to prevent deception by the enemy. Voice and style recognition may be used to augment authentication but will not serve as a substitute for an authorized authentication system.

Antijamming measures start with the design of the electronic equipment, but it cannot stop there. Commanders and staff officers must realize the enemy's ECM capability and provide for appropriate defensive measures in their orders, plans, and SOP's. Antijamming measures for tactical radio communication include station siting, diversity of frequencies, alternate frequencies and call signs, and a system to implement their use when necessary. The Signal Operation Instructions should make alternate frequencies and call signs available for timely use when an operating frequency is jammed, but the unit SOP must provide for the implementation of the antijamming measures. The unit SOP should include procedures for:

- (1) Siting radios prior to jamming to provide maximum operating efficiency and protection from potential jamming.

- (2) Changing to an alternate frequency, including the method of disseminating the order to change frequencies. Call signs of all stations in the net must be changed simultaneously with the shift to alternate frequency.

- (3) Continued operation on a jammed frequency to keep the jammer occupied on that frequency

(4) Reporting jamming or other ECM activity. The SOP should indicate when and to whom to report and what information is required.

MOST IMPORTANT STEP—OPERATOR TRAINING

All plans and procedures are ineffective unless they are followed up with the most important step of all—adequate operator training. Inadequate training would increase the likelihood of surprise and confusion of communication personnel. The operator must learn to accept the inevitability of jamming. He must be subjected continuously to jamming during all phases of training. This experience teaches him to operate his equipment to counteract the effects of jamming in some cases and, at least, to increase the effectiveness of his equipment under jamming conditions. Operators must be taught to adhere to the following fundamental defensive practices:

(1) Transmission discipline must be employed. The shortest possible transmission time is important to successful antijamming measures. Excessive transmission invites enemy jamming and even shelling. The transmitter should be adjusted for the lowest radiated power required to maintain good communication. Unnecessary testing and checking of communication should be avoided.

(2) Jamming must be recognized. Disturbances are not always caused by external sources. If the disturbance is not eliminated by grounding or disconnecting the antenna, the trouble is internal; if it is eliminated, the trouble is external to the radio. If external interference is indicated, a further check must be made to determine whether the cause is enemy jamming or accidental interference. Jamming is of two basic types—spot jamming of a specific frequency and barrage jamming on a wide band of frequencies. Spot jamming can usually be distinguished from unintentional interference, since the intensity of spot jamming drops sharply when the receiver is tuned slightly off the operating frequency. Barrage jamming is not so easily distinguished, and a search of the area should be made to eliminate the possibility of interference from other radios, radar, or other electrical devices. Recognition is easier if the operator is familiar with the sound of jamming signals used by the enemy.

(3) The radio operator is responsible for getting the message through. Several techniques are available to radio operators for avoiding or combating the effects of jamming. Siting and antenna orientation are important factors in obtaining maximum station efficiency. In some cases, positioning the antenna so that hill formations, buildings, or other obstructions are between the antenna and the enemy will reduce or eliminate the effectiveness of enemy jamming. It is often advisable to use a directional antenna oriented so that maximum energy is radiated and received in the direction of the friendly station, minimum energy in the jamming station's direction. Even if the desired signal is blanketed by jamming, the operator must continue to operate, as a sudden halt indicates to the enemy that his jamming was successful. The transmitter

should be switched to full power and receiver controls should be manipulated in an attempt to improve reception.

(4) Prompt, accurate, and complete reporting of enemy jamming is important, since an enemy jamming attack is usually part of a well-organized plan and frequently precedes important tactical maneuvers. A detailed report of jamming is made to the commanding officer immediately after the jamming starts. This report must be forwarded promptly.

ECCM TRAINING MUST BE CONTINUOUS

Training in ECCM must be a continuous process. It is taught to officers and communication specialists at the US Army Artillery and Missile School, but this alone does not insure proficiency. The specialist training of communication personnel in all artillery units should include ECCM. It must be made a part of unit proficiency tests, field exercises, communication exercises, and command post exercises. Jamming and other ECM can usually be provided by supporting electronic warfare units. If necessary, one of the unit radios may be pressed into service as a jammer. Exposure to simulated jamming and deception under field conditions develops the skill and confidence needed by communication personnel and operational familiarity of commanders and their staffs. Further information on this subject is contained in FM 11-151, *Defense Against Electronic Jamming*, and FM 24-150, *Electronic Warfare (U) (C)*.

All equipment using electromagnetic radiation is subject to ECM. Radio communication is extremely vulnerable to enemy jamming. Jamming must be anticipated, provisions for antijamming measures must be included in all planning, and these activities must be controlled and coordinated. Whether or not enemy ECM tactics are effective will depend to an important degree upon the attitude and training of personnel.

A GEM FOR THE RADAR TECHNICIAN

Careful handling of cathode-ray tubes (CRT) is a "must" for the radar technician. The glass envelope of the CRT is evacuated to a high degree, subjecting the tube to considerable atmospheric pressure. For example, the total force exerted on a 10-inch CRT is approximately 3,750 pounds, almost two tons. For this reason, great care should be taken to avoid breaking the glass envelope.

Do not hold the tube by the narrow neck. When placing the CRT on the bench, stand it on its face, preferably on a felt pad, or something similar. Even if rough handling doesn't cause explosion, it might displace the element inside the tube, possibly affecting normal operation of the CRT. Care should also be exercised in disposing of a broken CRT, as the material used for coating the face of the CRT may be extremely toxic.

—Submitted by Mr. Baldwin G. Sullivan
Communication/Electronics Department